The Difference Characteristics of Presbycusis Patients between Indonesia and Global Populations: A Literature Review

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Abstract

Introduction: Presbycusis refers to a gradual and bilateral sensorineural hearing loss that develops over time as a result of aging. This condition typically manifests in the elderly but may occur earlier in individuals with certain risk factors. The precise cause of presbycusis remains unidentified, although several risk factors, such as age, gender, noise exposure, genetics, chemical exposure, smoking, and comorbid conditions like hypertension, diabetes mellitus, and hypercholesterolemia, are associated with its development. Epidemiological research is predominantly conducted in developed countries. Moreover, developing countries with lower socioeconomic status exhibit increased risk factors that impact the onset and severity of presbycusis. Various studies conducted in different Indonesian cities, such as Denpasar and Gianyar, Bali; Semarang; Bandung; and Banten show the characteristics of presbycusis patients in its region but do not represent the diverse characteristics of presbycusis in Indonesia, especially those influenced by factors like age, gender, and comorbidities. Therefore, we need the literature that specifies the characteristics of presbycusis in Indonesia.
Objective: This literature review aims is to specify the difference in characteristics of presbycusis patients between Indonesia and global populations.
Method: A literature review was conducted through PubMed, Science Direct, Scopus, Web of Science, and ProQuest databases, searching for studies related to presbycusis, especially in Indonesia which met the inclusion and exclusion criteria.
Result: According to the review, both Indonesia and global populations show that presbycusis often occurs in the 60s and increases with age. Global populations show that men are more likely to get presbycusis than women. However, in some populations in Indonesia, such as Bandung and Gianyar, women are higher than men. In Indonesia, these comorbid diseases show no significant impacts through presbycusis. There were comorbid diseases, such as ear infection, hypertension, hypercholesterol, and history of smoking in presbycusis patients but the results show no or little impacts on presbycusis patients in Indonesia, although these have often been mentioned as risk factors for global populations.
Conclusion: The review did not find a significant difference in characteristics of presbycusis related to age and comorbid diseases between Indonesia and global populations, but there were differences in characteristics of presbycusis related to sex.

Keywords: Presbycusis; age-related hearing loss; characteristics; Indonesia

1. Introduction

Presbycusis refers to a gradual and bilateral sensorineural hearing loss that develops over time as a result of aging.[1] This condition typically manifests in the elderly but may occur earlier in individuals with certain risk factors.[2] The precise cause of presbycusis remains unidentified, although several risk factors, such as age, gender, noise exposure, genetics, chemical exposure, smoking, and comorbid conditions like hypertension, diabetes mellitus, and hypercholesterolemia, are associated with its development.[3] The onset of presbycusis typically occurs after the age of 60, though there can be variations.[2]

Epidemiological research is predominantly conducted in developed countries. Globally, the World Health Organization reports that 30-45% of individuals over 65 experience presbycusis, totaling 360 million people with hearing impairments worldwide.[4] In the United States, presbycusis affects 26.8% of those aged 60-69, 55.1% of those aged 70-79, and 79.1% of those aged over 80.[5] In China, presbycusis affects particularly in the elderly, at 79.13%.[6] Moreover, developing countries with lower socioeconomic status exhibit increased risk factors that impact the onset and severity of presbycusis.[2] Indonesia as one of the developing countries with a significant elderly population of 29.3 million, reports a 36.6% prevalence of hearing impairment in those over 75 and 17.1% in the 65-74 age group.[7-8] Nevertheless, Indonesia faces a lack of studies on the characteristics of presbycusis due to the need for resources that are not consistently accessible. [9-13] Various studies conducted in different Indonesian cities, such as Denpasar and Gianyar, Bali; Semarang; Bandung; and Banten show the characteristics of presbycusis patients in its region but do not represent the diverse characteristics of presbycusis in Indonesia, especially those influenced by factors like age, gender, and comorbidities.[9-13]

The impact of presbycusis extends beyond hearing loss, significantly affecting the quality of life by disrupting communication, social interactions, cognitive function, and potentially leading to mental disorders like anxiety and depression.[14-15] Because of the huge population of elderly in Indonesia, the impacts of presbycusis can significantly contribute to disability in old age, resulting in handicaps in the community.[2,7-8] Therefore, we need the literature that specifies the characteristics of presbycusis in Indonesia.

2. Objective

This literature review aims is to specify the difference in characteristics of presbycusis patients between Indonesia and global populations.

3. Methods & Materials

A literature review was conducted through PubMed, Science Direct, Scopus, Web of Science, and ProQuest databases, searching for studies related to presbycusis, especially in Indonesia. The following search query (“Presbycusis” OR “age-related hearing loss” OR “hearing loss in elderly”) was used. Only papers written in English or Indonesian, a language that the authors could comprehend were allowed to be included in this review.

Inclusion criteria to filter the result were set as: (1) study population consisting of presbycusis patients with/without comorbid disease in Indonesia or global populations. Exclusion criteria were also applied: (1) access to paid articles (2) language other than English or Indonesian.

Data extraction consisted of study information (author, year, country or city), research design, duration, population, characteristics (age and gender), comorbid diseases, and highlight findings.

4. Result and Discussion

No	Author, Year Country (City)	Research Design Duration Population (n)	Age Gender	Comorbid Diseases	Highlight Finding
Indonesia					
1	Ario, 2019 Indonesia (Bandung)	Descriptive with cross-sectional study March-May 2019 135	46-55: 35,56% 56-65: 22,96% >65: 41,48% Men: 35,56% Women: 64,4%	Ear infection: 7,41% Hypertension; 7,41% History of smoking: 5,93% No comorbidities: 79,25%	The prevalence of women is higher than men in presbycusis patients
2	Nuryadi, 2016 Indonesia (Denpasar)	Descriptive with cross-sectional study January 2013-December 2014 34	60-70: 67,75% 71-80: 32,35% Men: 76,47% Women: 23,53%	-	
3	Melinda, 2012 Indonesia (Semarang)	Analytic case-control study April-June 2011 90 Cases: 45 Control: 45	Cases: ≥75: 17,9% <75: 32,2% Control: ≥75: 7,8% <75: 42,2% -	Cases: Hypertension(+): 35,6% Hypertension(-): 14,4% Diabetes Mellitus(+): 21,1% Diabetes Mellitus(-): 28,9% Hypercholesterol(+): 24,4% Hypercholesterol(-): 25,6% History of smoking(+): 21,1% History of smoking(-): 28,9% Control: Hypertension(+): 23,3% Hypertension(-): 26,7% Diabetes Mellitus(+): 22,2% Diabetes Mellitus(-): 27,8% Hypercholesterol(+): 20% Hypercholesterol(-): 30% History of smoking(+): 15,6% History of smoking(-): 34,4%	Hypertension in patients with presbycusis is higher than in patients with no presbycusis Diabetes Mellitus shows no significant results Hypercholesterol in patients with presbycusis is higher than patients with no presbycusis History of smoking in patients with presbycusis is higher than in patients with no presbycusis
4	Dina (2013) Indonesia (Banten)	Descriptive with cross-sectional study July-August 2013 60 Cases: 13	- -	Cases: Hypertension(+): 11,7% Hypertension(-): 10% Diabetes Mellitus(+): 1,7% Diabetes Mellitus(-): 20% Hypercholesterol(+): 3,3% Hypercholesterol(-): 8,3%	Hypertension in patients with presbycusis is slightly higher than in patients with no presbycusis but shows no significant

		Control: 47		History of smoking(+): 6,7% History of smoking(-): 15% Control: Hypertension(+): 41,7% Hypertension(-): 36,7% Diabetes Mellitus(+): 6,7% Diabetes Mellitus(-): 71,7% Hypercholesterol(+): 20% Hypercholesterol(-): 35% History of smoking(+): 26,7% History of smoking(-): 51,7%	results Diabetes Mellitus shows no significant results Hypercholesterol shows no significant results History of smoking shows no significant results
5	Danastri, 2021 Indonesia (Gianyar)	Descriptive with cross-sectional study September 2017 50	65-69: 48% 70-74: 30% ≥75: 18% Men: 40% Women: 60%	-	The prevalence of women is higher than men in presbycusis patients
Global Populations					
6.	Kim, 2010 Korean	Descriptive with cross-sectional study January 2004-September 2005 1116	There are no percentages but show a rate of change (increase) in older age There are no percentages but show the increased prevalence of men higher than women	-	
7.	Kaya, 2015 Turkey (Istanbul)	Retrospective study July-December 2013 1134	- Men: Strial: 25,9% Sensory: 64,4% Cochlear: 45,8% Women: Strial: 74,1% Sensory: 35,6% Cochlear: 54,2%	-	The prevalence of women is higher than men in strial presbycusis, but lower in sensory and cochlear presbycusis patients.
8.	Sousa, 2009 Brazil	Observational cross-sectional study	Cases: <61: 85% 61-65:7,5%	Cases: Hypertension(+): 37,2% Hypertension(-):62,8%	Hypertension show no significant results Diabetes Mellitus

		January 2001-August 2005 625 Cases: 226 Control: 399	≥65: 7,5% Control: <61: 97,2% 61-65: 1,5% ≥65:1,3% Cases: Men: 91,6% Women: 8,4% Control: Men: 82% Women: 18%	Diabetes Mellitus(+): 7,1% Diabetes Mellitus(-): 92,9% Family History of Hypercholesterol(+):9,3% Family History of Hypercholesterol(-):90,7% History of smoking(+):23% History of smoking (-):77% Control: Hypertension(+):33,3% Hypertension(-):66,7% Diabetes Mellitus(+): 2,8% Diabetes Mellitus(-): 97,2% Family History of Hypercholesterol(+):9,4% Family History of Hypercholesterol(-):90,6% History of smoking(+):22,1% History of smoking (-):77,9%	show no significant results Hypercholesterol show no significant results History of smoking shows no significant results
9.	Lin, 2011 United States	Retrospective study 2001-2008 7490	There are no percentages but show a rate of change (increase) in older age There are no percentages but show the increased prevalence of men higher than women	-	-
10.	Nash, 2011 United States (Wisconsin)	Population-based cohort study 2005-2008 2837	≤55: 32,2% 55-64: 25,1% 65-84: 42,7% Men: ≤55: 16,6% 55-64: 35,9% 65-84: 55,1% Women: ≤55: 5,9% 55-64: 15,6% 65-84: 33%	Hypertension; 38,4% Diabetes Mellitus: 6,3% Hypercholesterol: 39,3% History of smoking: 17,7% History of ear infection: 57,9% Statin use: 15,2% NSAID use: 59,5% Noisy job: 43,9% Obese: 44,7%	-

Figure 1. Study characteristics

The study characteristics are displayed in Figure 1. Five studies were conducted in Indonesia, there were from different cities (Bandung, Denpasar, Semarang, Banten, and Gianyar). Five studies left represented the global population conducted in different countries (Korea, Turkey, Brazil, and two from the United States).

Presbycusis increases with age.[2] According to the review, both Indonesia and global populations show that presbycusis often occurs in the 60s and increases with age.[3,5, 9-13, 16-18] Presbycusis manifests from early adulthood and declines progressively with aging, attributable to cellular damage resulting from escalating and accumulating oxidative stress over an extended period.[20] The disease is more common in men than women due to hormone differences, the alpha and beta estrogen receptors which are rich in women, are located in the inner and outer hair cells of the spiral ganglion.[19] These receptors are present in the vascular stria and spiral ligament, where the homeostasis of the inner ear is maintained, thereby influencing signal transmission and cochlear homeostasis.[19] According to the review, global populations show that men are more likely to get presbycusis than women.[3,5, 16-18] However, in some populations in Indonesia, such as Bandung and Gianyar, women are higher than men.[9-13] The different results may caused by the research sample in Indonesia being less varied, so the interpretation of the data was less heterogeneous.

The onset and severity of presbycusis can vary depending on multifactorial conditions.[2] These factors are white race, low socioeconomic status, loud noise exposure to ototoxins, otologic infections, smoking, hypertension, diabetes, vascular disease, immunologic disorders, and hormonal factors.[2] Genetic, dietary factors and loud noise exposure also can hasten the presbycusis.[2] In global populations, comorbid diseases, such as hypertension, diabetes mellitus, hypercholesterol, history of smoking, history of ear infection, history of drugs, noisy job, and obesity show the impacts in presbycusis, these factors increase the reactive oxidative stress which can damage the ear hair cells.[1, 3,5, 16-18]

According to the review, in Indonesia, these comorbid diseases show no significant impacts through presbycusis.[9-13] There were comorbid diseases, such as ear infection, hypertension, hypercholesterol, and history of smoking in presbycusis patients but the results show no or little impacts on presbycusis patients in Indonesia, although these have often been mentioned as risk factors for global populations.[9-13]

This review has some limitations, including the inclusion of just English and Indonesian language studies, which may have led to the exclusion of additional relevant studies. There were also some limitations of specifications of characteristics presbycusis in Indonesia due to the minimum number of related journals. In addition, although this study did not find a significant difference in characteristics of presbycusis related to age and comorbid diseases between Indonesia and global populations, there were differences in characteristics of presbycusis related to sex. Further studies are expected to have better quality to confirm the results of this review.

5. Conclusion

Presbycusis can be caused by the multifactorial condition that is related to age and comorbid disease changes in the auditory system and the brain. The review did not find a significant difference in characteristics of presbycusis related to age and comorbid diseases between Indonesia and global populations, but there were differences in characteristics of presbycusis related to sex.

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